Screening of Effective Leaf Extracts for Weed Management in Little Millet (*Panicum sumatrense)*

ABSTRACT

Aim: Field experiment was conducted to screen best leaf extracts as an alternative to chemical herbicides by non-chemical weed management approach in little millet owing to the great surge of organic farming in millet production nowadays.
Study design: This experiment laid out in a randomized block design and was replicated twice with 15 different treatments.
Place and Duration of Study: Field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore in February 2022 (30 days trail).
Methodology: Screening trail was started at 04.02.2022 on ATL-1 variety of little millet with spacing 30×10cm in 1×1m^2 plot and harvested at 07-03-2022.Different tree leaves (Tamarind, Casuarina, Castor, Papaya, Pine, Nerium flowers) disease and pest free leaves are collected from college surroundings and made an aqueous leaf extract for controlling weeds in little millet crop. Weed observations (weed density and weed dry weight) have been taken on 10 and 20 DAS respectively.
Results: The findings of this investigation demonstrated that the pre emergence (3 DAS) application of Tamarind leaf extract (30%), Casuarina leaf extract (30%), Castor leaf extract (30%), Papaya leaf extract (30%), Teak leaf extract (30%), Pine leaf extract (30%) and Nerium leaf extract (30%) pronounced the lowest weed density and highest weed control efficiency among fifteen treatments
Conclusion: Based on the results of the experiment, it was concluded that pre emergence application of any different leaf extract, Tamarind, Casuarina, Castor, Papaya, Teak, Pine, and Nerium leaf extracts with 30% concentration had found the allelopathic potential to reduce the weed density and recorded high weed control efficiency with no phytotoxicity on the little millet.

1. INTRODUCTION:

Little millet is employed as a nutrient-rich food crop in India. In India, the Eastern Ghats ranked top in little millet production and diet among native tribes and it extends to Nepal, Sri Lanka, and Myanmar. Because this millet helps people of all ages, it is regarded as wonderful millet. Per 100 grams of little millet has 8.7 grams of protein, 75.7 grams of carbohydrates, 5.3 grams of fat, 1.7 grams of minerals, and 9.3 milligrams of Iron .Although minor millets are a good supply of nutrients,minerals, and they are resistant to drought and stress in rainfed agriculture[1].Farmers are shifting away from minor millets and toward other cereal and cash crops in order to increase their revenue[2].

Weeds compete with crops during the early stages of crop growth; hence a management approach that assures early season weed suppression in crops is critical for crop growth, development, and production. Weeds are often handled manually in conventional management approaches, manual weeding is regarded the most effective control, but its usage has declined due to a manpower scarcity for large-scale agricultural production and rising labour costs[3]. Millets can grow under drought situations and can adapt to climate change. To increase demand for new and contemporary items, it is critical to concentrate on boosting production because of the decline in soil health and fertility caused by toxic chemicals released by herbicides and pesticides. As a result, there is a greater need for sustainable agriculture and eco-friendly alternatives to toxic substances in millet production. Plant allelopathy is an excellent alternative to the use of hazardous chemical herbicides in weed control [4].Plant-based herbicides are becoming increasingly popular. Weed management with plant extracts is an environmentally beneficial solution. As a result, an attempt will be made to produce plant-based herbicides based on distinct leaf extracts in Little Millet.

2. MATERIALS AND METHODS:

A field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore during winter (February 2022) .The trail site is located at 9^o 54'N latitude and 78^o 54'E longitude at an altitude

of 147 m above mean sea level. Screening trail was started (Date of sowing) on 04.02.2022 with ATL-1 variety of little millet, spacing taken up was 30×10 cm and raised crop up to critical weed competition, 30-40 DAS. Weed observations (weed density and weed dry weight) have been taken on 10 and 20 DAS respectively. Soil from the site contains a pH-9.4, EC-0.4 dS/m, Organic carbon-0.45 % ,low nitrogen-174 kg/ha, medium phosphorus-19kg /ha, high potassium- 520kg/ha and this experiment was laid out with randomized block design and replicated twice with plot size 1×1 m dimension. The treatments composed with different leaf extracts, Tamarind leaf extract, Casuarina leaf extract , Castor leaf extract, Papaya leaf extract, Teak leaf extract, Pine leaf extract, Nerium flower extract @ 20 & 30% concentration each respectively and Unweeded check.

Preparation of leaf extracts:

Leaf species free from diseases and pests were collected from surroundings of TNAU and washed gently. After cleaning, washed leaves were chopped into small pieces and undergone to soaking for 12 hrs/whole night in 1:1 ratio(leaves : water) and ground into paste with grinder. The paste of each leaf species has to be filtered through whatt man no 1 paper and it represents stock solution (100% concentration)[Fig 1] [5,6].From stock solution required amount of concentration has to be prepared i.e., 20% and 30% concentration.

Preparation of Nerium flower extract:

Disease and pest free flowers were collected and dried in shade dry for 3 days and kept dried flowers in hot air oven at 70℃ for 2 days and made it fine powder. The flower powder weigh for required amount i.e., 20 and 30 g for [Fig 2] (20 & 30 % concentration) in 1 litre of distilled water [7].

Weed Control Efficiency:

The predominant weed species in experimental field was identified and grouped into grasses, sedges and broad leaved weeds. Weed observations have been taken by using quadrant 0.25× 0.25m from each plot and separated into grasses,sedges,broad leaved weeds and density was documented and expressed in number/m^2 .Later collected weed species get dried in shade and kept in hot air oven for 70℃ and observations of weed dry weight is taken. Weed Control Efficiency was worked out as per the protocol proposed by mani *et al.,* [8] and indicated in percentage.

$$WCE = \frac{Wpc - Wpt}{Wpc} \times 100$$

Wpc - Weed population in control plot,

Wpt - Weed population in treatment plot

The experimental data obtained throughout were statistically analysed by adopting Fisher's method of ANOVA suggested by Gomez and Gomez [9]. The data on weed density and weed dry weight were subjected to square root transformation ($\sqrt{x + 0.5}$).

3. RESULTS AND DISCUSSION:

The predominant weed species observed in the trail was *Chloris barbata,Cyanadon dactylon ,Dactyloctenium aegyptium., Echinocloa colonum* in grasses , *Cyperus rotandus* in sedges and *Amaranthus viridis, Trianthema protulacastrum, Digeria arvensis ,Physalis minima, Euphorbia hirta* in broad leaved weeds similar weed species were observed in millet crops at Tamil Nadu region was reported by Mishra [10].

Grasses showed dominance than broad leaved weeds at 10 and 20 DAS. In grasses *Chloris barbata* (61 & 56 %) projected high relative density among grasses at both 10 and 20DAS respectively. In broad leaved weeds *Trianthema portulacastrum* (37.17 & 31%) recorded high relative density (Figure no 3 &4) .Sedges were not affected significantly to any treatments.

Different treatments have a significant impact on grass density. Among all the treatments lowest weed density of grass resulted in Papaya leaf extract @ 30% concentration (20 no/m^2) at 10 DAS, Casuarina leaf extract @ 30 % concentration (29 no/m^2) recorded least grass density at 20 DAS. Broad leaved weeds are less dominated compared to grasses in micro plot field (Fig no 5);

same result trend was reported by Mc hung *et al.,* [11]. The lowest broad leaved weed density is observed in Castor leaf extract @ 20 & 30 % concentration (2.11,2.11 no/m^2) respectively at 10 DAS and Casuarina leaf extract @ 30 % concentration par with Castor leaf extract @20 % concentration at 20 DAS (4,4 no/m^2)(Table no 1.).Similar result revealed] by Anwar *et al.,*[12] applying 10-20% methanol extracts pronounced weed inhibition.

The overall dry weight of the weed was significantly reduced in the treatment of Tamarind leaf extract 30% conc (3.33g/m^2) [13] followed by Teak leaf extract 30% conc (5.33 g/m^2)(Table no 2).The highest weed density can be seen in control so similarly highest dry weight reported in control (Unweeded check)(Fig no 6) plot.

Weed control efficiency calculated at 10 and 20 DAS.Among all the treatments Papaya leaf extract @ 30 % concentration and Castor leaf extract 30% concentration declared 80 and 68.22 % WCE at 10 and 20 DAS respectively (Fig no 5) and no sedge density was recorded in Casuarina leaf extract @ 20% concentration and Papaya leaf extract @ 30 % concentration on both 10 and 20DAS respectively.

Anwar *et al.,*[14] Suggested that using papaya aqueous leaf extract has great weed growth inhibition than leaf powder.

Fig 1 Stock solution

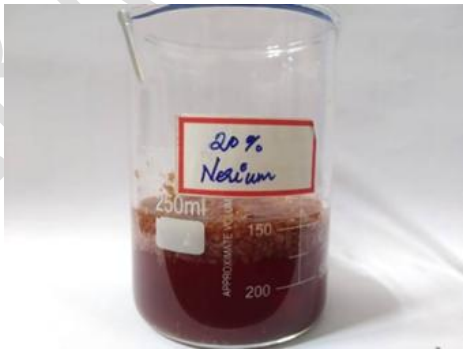

Fig 2 Flower powder solution

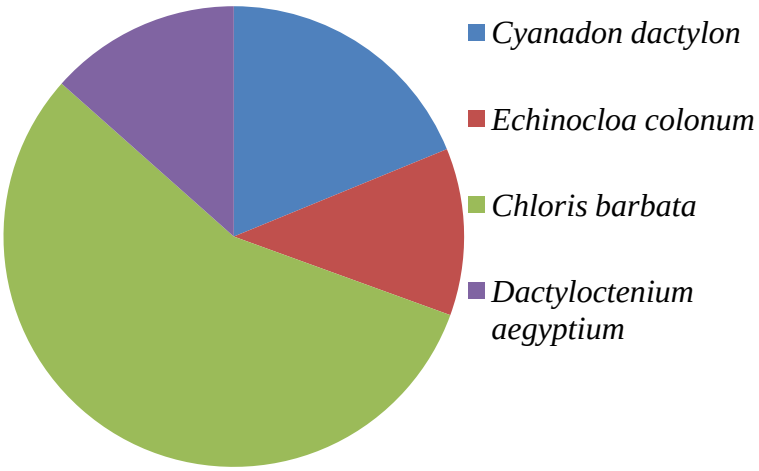

Fig no 3.Effect of different leaf extracts on relative density of grasses at 20 DAS in little millet

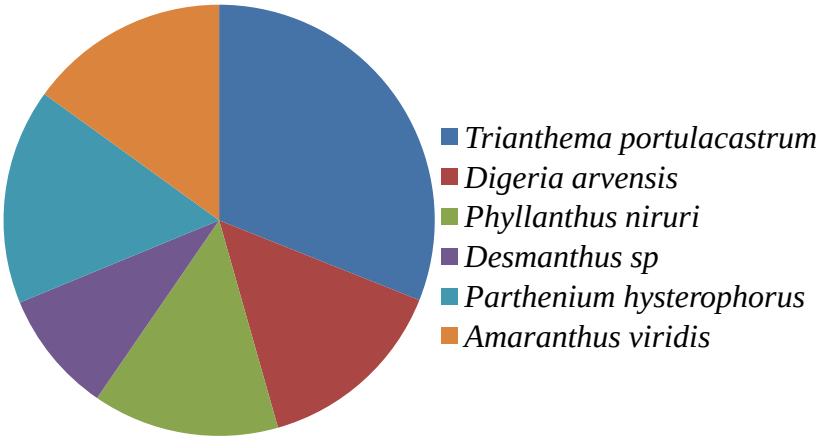

Fig no 4.Effect of different leaf extracts on relative density of broad leaved weeds at 20 DAS in little millet

Table no 1.Effect of different leaf extracts on weed density (no/m^2).

T.No.	Treatments	Grasses		Sedges		BLW	
		10 DAS	20DAS	10DAS	20DAS	10 DAS	20DAS
T_1	PE application of Tamarind @ 20%	7.60 (57.5)	8.72 (75.5)	2.25 (5)	2.48 (6)	2.82 (7.5)	3.16 (9.5)
T_2	PE application of Tamarind @ 30%	5.75 (34)	6.89 (51)	1.42 (2)	1.42 (2)	2.91 (8)	3.00 (8.5)
T_3	PE application of Casuarina @ 20%	7.08 (49.5)	7.25 (53.5)	0.71 (0)	0.71 (0)	2.55 (6)	2.40 (5.5)
T_4	PE application of Casuarina @ 30%	5.24 (27)	5.47 (29.5)	1.29 (1.5)	1.29 (1.5)	2.52 (6)	1.82 (4)
T_5	PE application of Castor @ 20%	6.85 (46.5)	8.40 (70)	1.98 (5)	2.05 (5.5)	2.11 (4)	1.79 (3)
T_6	PE application of Castor @ 30%	5.99 (35.5)	5.79 (33)	1.73 (3.5)	0.97 (0.5)	2.11 (4)	2.11 (4)
T_7	PE application of Papaya @ 20%	6.36 (40)	6.37 (40.5)	1.5 (2.5)	1.15 (1)	2.74 (7)	2.31 (5)
T_8	PE application of Papaya @ 30%	4.48 (20)	6.60 (43)	0.71 (0)	0.71 (0)	1.73 (3.5)	2.72 (7)
T_9	PE application of Teak @ 20%	6.24 (39)	7.25 (52)	0.97 (0.5)	2.21 (4.5)	2.80 (7.5)	2.25 (5)
T_{10}	PE application of Teak @ 30%	5.47 (30.5)	6.40 (40.5)	1.27 (1.5)	1.67 (2.5)	2.55 (6)	2.55 (6)
T_{11}	PE application of Pine @ 20%	7.17 (51)	8.37 (71.5)	1.97 (3.5)	0.71 (0)	2.63 (7)	2.12 (4)
T_{12}	PE application of Pine @ 30%	5.96 (35)	7.05 (49.5)	1.1 (1)	1.15 (1)	2.74 (7)	2.43 (5.5)

T_{13}	PE application of Nerium flower extract @ 20%	8.06 (64.5)	8.77 (77)	1.29 (1.5)	1.29 (1.5)	2.80 (7.5)	2.55 (6)
T_{14}	PE application of Nerium flower extract @ 30%	5.86 (34)	6.83 (46.5)	1.29 (1.5)	1.42 (2)	2.74 (7)	2.52 (6)
T_{15}	CONTROL	9.04 (81.5)	10.25 (105.5)	3.58 (5)	2.90 (8.5)	4.85 (23)	5.09 (25.5)
SEd		0.78	0.88	0.96	0.86	0.51	0.55
CD (*P*=.05)		1.68	1.90	NS	NS	1.10	1.18

PE-Pre emergence at 3 days after sowing.

Data in parentheses are original value.

Data statistically analysed by $\sqrt{x+0.5}$ transformation

Table no 2.Effect of different leaf extracts on total weed density (no/m^2) & total weed dry weight (g/m^2)

T.No.	Treatments	Total weed density		Total weed dry weight
		10DAS	20 DAS	20 DAS
T_1	PE application of Tamarind @ 20%	8.69 (70)	9.33 (86.50)	2.52 (6.33)
T_2	PE application of Tamarind @ 30%	6.62 (44)	7.13 (55.5)	1.83 (3.33)
T_3	PE application of Casuarina @ 20%	7.49 (55.5)	7.60 (59)	3.34 (11.17)
T_4	PE application of Casuarina @ 30%	5.89 (34.5)	6.52 (42)	2.70 (7.33)
T_5	PE application of Castor @ 20%	7.45 (55.5)	8.88 (78.5)	3.27 (10.67)
T_6	PE application of Castor @ 30%	6.60	6.44	2.49

		(43)	(41)	(6.17)
T_7	PE application of Papaya @ 20%	7.05 (49.5)	6.82 (46.5)	3.16 (10.00)
T_8	PE application of Papaya @ 30%	4.80 (23.5)	7.11 (50)	2.55 (6.67)
T_9	PE application of Teak @ 20%	6.86 (47)	7.61 (57.5)	3.13 (9.83)
T_{10}	PE application of Teak @ 30%	6.13 (38)	6.96 (48)	2.31 (5.33)
T_{11}	PE application of Pine @ 20%	7.88 (61.5)	8.84 (79)	2.73 (7.67)
T_{12}	PE application of Pine @ 30%	6.56 (43)	7.49 56)	2.35 (5.67)
T_{13}	PE application of Nerium flower extract @ 20%	8.61 (73.5)	9.41 (88.5)	2.65 (7.0)
T_{14}	PE application of Nerium flower extract @ 30%	6.55 (42.5)	7.28 (53)	2.58 (6.67)
T_{15}	CONTROL	10.86 (117.5)	11.37 (129)	3.78 (14.33)
SEd		0.79	0.82	0.32
CD (*P*=.05)		1.69	1.76	0.68

PE-Pre emergence at 3 days after sowing.

Data in parentheses are original value.

Data statistically analysed by $\sqrt{x + 0.5}$ transformation

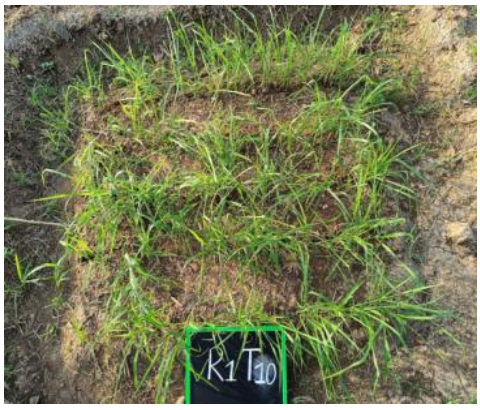

Fig no 5 Treatment (R_1T_{10})

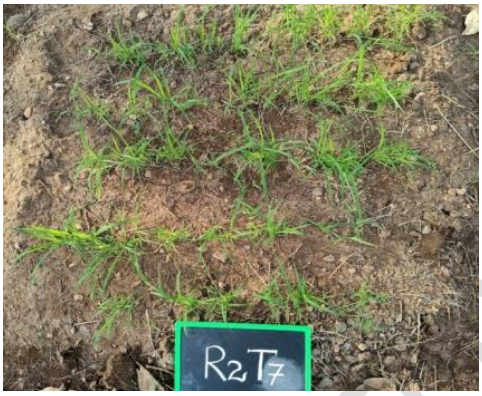

Fig no 6 Treatment (R_2T_7)

Fig no 7 Treatment (R_1T_{15})

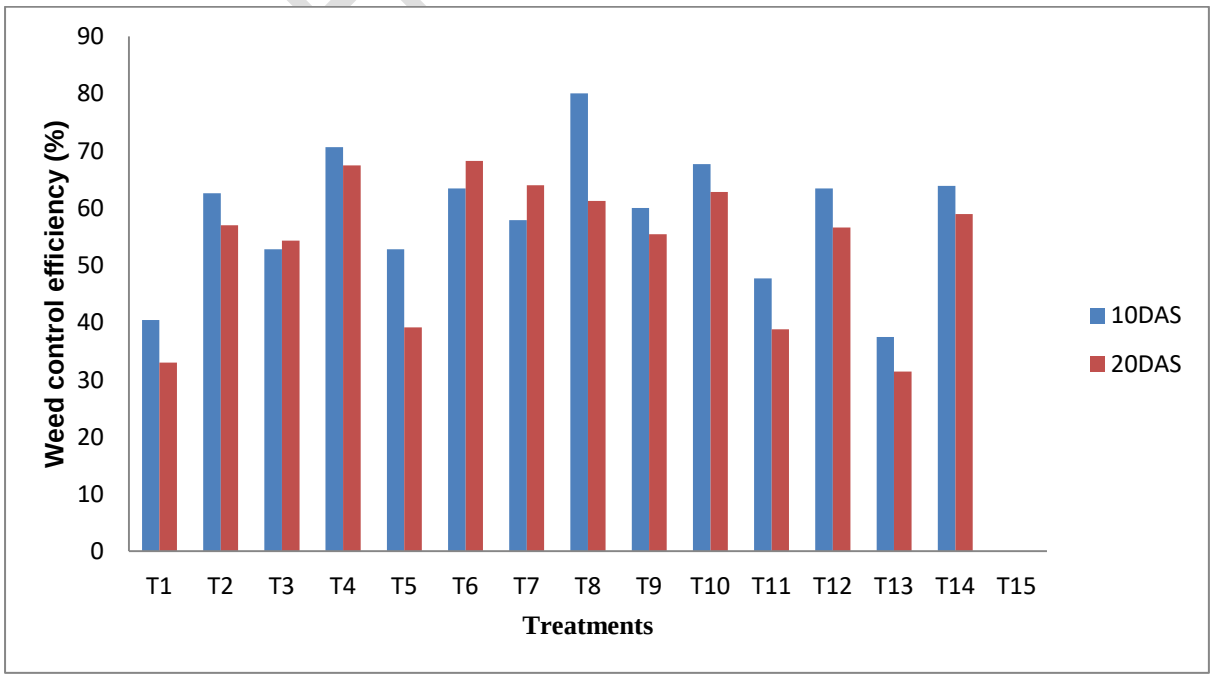

Fig no 8. Effect of different leaf extracts on weed control efficiency (%) in little millet

4. CONCLUSION:

From the experiment conducted, it could be concluded that application of 30% concentration of Tamarind, Casuarina, Castor, Papaya, Teak, Pine, Nerium leaf extracts before emergence of weeds and crop on 3 days after sowing recorded higher weed control efficiency and no phytotoxicity. Hence these leaf extracts @ 30% concentration might be used for weed control in little millet crop of organic production systems.

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